REPORT DOCUMENTATION PAGE			Form Approved OM8 No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE		3. DATES COVERED (From - To)
30-06-2008	FINAL REPORT		JULY 2007 TO JULY 2008

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Combat Related Environmental Risk Factors as Predictors of Self-Rated Health	
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	5d. PROJECT NUMBER
SEXTON, DONALD, W, CPT, MS	
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Madigan Army Medical Center Bldg 9040 Fitzsimmons Drive Tacoma, WA 98431	

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
U.S. Army Medical Department Center and School Bldg 2841 MCCS-HFB (Army-Baylor Program in Health and Business Administration) 3151 Scott Road, Suite 1411 Fort Sam Houston, TX 78234-6135	
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) 7-08

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The purpose of this study is to examine the correlates of combat related environmental risk factors with the self-rated health of U.S. Army Soldiers returning from a combat deployment. This study is a single cross sectional analysis examining a sample of 7,315 Health Risk Assessment Survey II surveys collected from active duty Soldiers in the Western Regional Medical Command (WRMC) from 2007 to 2008. Multiple linear regression was used for data analysis and to develop a predictive model. The dependent variable, self-rated health, was analyzed with eight combat related environmental factors (physical and psychological) and three individual demographic factors. An adjusted model was developed. Results indicate that the 6.7% of the variance in the self-rated health be attributed to the variance in the adjusted model. The statistical evidence suggests that the model's independent variables are significant predictors of self rated health ($F(8, 7,306) = 66.21$, $p = <.001$). Obtaining higher education was the most salient predictor of better self-rated health. The occurrence of physical injury or harm during combat was the most salient predictor of poorer health.

15. SUBJECT TERMS

Self-rated health, Post deployment health re-assessment (PDHRA), Health Risk Assessment Survey II, Soldier Wellness Assessment Program (SWAP), Combat related environmental risk factors.

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Education Technician
U	U	U	UU	36	**19b. TELEPHONE NUMBER (Include area code)** (210)221-6443

Army-Baylor University Graduate Program in Health and Business Administration

Combat Related Environmental Risk Factors as Predictors of Self-Rated Health

Graduate Management Project

CPT Donald W. Sexton

U.S. Army-Baylor Graduate Program in

Health and Business Administration

Preceptor: COL Julie M. Martin

Faculty Reader: A. David Mangelsdorff, Ph.D., M.P.H.

20090210065

Acknowledgements

Disclosure As Called For By Army Regulation 360-5

The opinion or assertions contained herein are the private view of the author and are not to be considered as official policy or position, or as reflecting the views of the Department of The Army, the Department of Defense or the United States Government.

Interested parties please contact the author via e-mail at *donald.sextongwin@amedd.army.mil*

Ethical Considerations

No personal identifying information was used during this study. The author declares no conflict of interest or financial interest in any product or service mentioned in this paper. The confidentiality of individual members of the study population was protected at all times throughout the study. On November 7, 2007, The Madigan Army Medical Center Institutional Review Board approved this protocol as exempt in accordance with AR 40-38, Clinical Investigation Program, Appendix B-6: Research Involving the Collection or Study of Existing Data, Documents, Records, and Pathological or Diagnostic Specimens and in accordance with 45 CFR 46.101 (b) (4): Research Involving the Collection or Study of Existing Data, Documents, Records, Pathological Specimens, or Diagnostic Specimens.

Abstract

The purpose of this study is to examine the correlates of combat related environmental factors with the self-rated health of U.S. Army Soldiers returning from a combat deployment. The data used for this study are collected through the Soldier Wellness Assessment Program (SWAP) using the Health Risk Assessment Survey II (HRA IIv2). This survey is designed to identify physical and mental health concerns of Soldiers 90-180 days after their return from a deployment. This study is a single cross sectional analysis examining a sample of 7,315 HRA IIv2 surveys collected from active duty Soldiers in the Western Regional Medical Command (WRMC) from 2007 to 2008. Multiple linear regression is used for data analysis and to develop a predictive model. The dependent variable, self-rated health, is analyzed with eight combat related environmental factors (physical and psychological) and three individual demographic factors. Initial results of the full model indicate all factors are correlated with self-rated health; however, several combat related environmental factors showed signs of covariation. An adjusted model was developed based on the initial multiple linear regression analysis. Results indicate that the 6.7% of the variance in the self-rated health be attributed to the variance in the adjusted model. The statistical evidence suggests that the model's independent variables are significant predictors of self rated health ($F_{(8, 7,306)} = 66.21$, $p = <.001$). Obtaining higher education was the most salient predictor of better self-rated health. The occurrence of physical injury or physical harm during combat was the most salient predictor of poorer health. This study demonstrates that conducting and evaluating an HRAIIv2 survey can serve as a basis for assessing and/or implementing successful preventative health plans for the U.S military.

Table of Contents

List of Figures and Tables

Predictors of Self-Rated Health Status

Introduction

Conditions that Prompted the Study

Since October 2001, approximately 1.64 million U.S. service members have been deployed in support of the Global War on Terrorism in Iraq and Afghanistan (Tanielian and Jaycox, 2008). The conflict is persistent and has been the most sustained ground combat operations involving American forces since the Vietnam era (Seal, Bertenthal, Miner, Sen, and Marmar, 2007). The majority of deployed military personnel experience high-intensity guerrilla warfare and the chronic threat of roadside bombs and improvised explosive devices. Some soldiers endure multiple tours of duty; many experience traumatic injury and more of the wounded survive than ever before (Seal et al., 2007).

Recent studies have suggested high rates of mental health disorders including posttraumatic stress disorder (PTSD), depression, and alcohol use disorders among active duty military personnel and veterans of Operation Iraqi Freedom (OIF) and, to a lesser extent, Operation Enduring Freedom (OEF) (Tanielian and Jaycox, 2008; Seal et al., 2007). The majority of returning service members are likely to exhibit some distress responses after serving in a combat environment. These symptoms are typically mild to moderate in severity and usually remit over a period of several weeks. When these symptoms persist they have the potential to become a problem. Thus, it is imperative to conduct health surveillance in order to provide early detection of medical conditions and medical intervention (Tanielian and Jaycox, 2008).

Force health protection is integral to the readiness of active duty, reserve, and guard military personnel. In order to ensure such protection, it is necessary to conduct ongoing surveillance of population health parameters using assessments of proven validity, accuracy,

reliability, and precision. Two instruments, the Post Deployment Health Assessment (PDHA) and the Post Deployment Health Re-Assessment (PDHRA), are currently in use by all branches and components of the military to assess the health status of service members returning from combat theaters (Under Secretary of Defense for Personnel and Readiness, 2006). The assessments are very similar; the redeployed service member completes a self-report questionnaire and then undergo a brief interview with a primary care physician, physician assistant, or nurse practitioner. The Soldier's portion of the form includes: demographic, general health, physical symptoms, and mental health items that may be deployment related. The clinician reviews the answers, conducts a brief interview, discusses options for care, and annotates any referrals. Clinicians are directed to use clinical judgment in determining who needs referral rather than relying on cutoff criteria that may not have sufficient predictive validity at a population level (Milliken, Auchterlonie, and Hoge, 2007).

In 2002, the staff of the WRMC developed the Health Risk Assessment Survey II (HRA IIv2) to assess the health of the redeploying Soldiers of the WRMC. This version was designed to meet the requirements of the PDHRA (same assessment as the PDHA, plus experience of injury and experience of exposure), in addition to enhancing the clinical assessment, to include: (a) several scales for assessing the target conditions of the PDHRA (e.g., Patient Health Questionnaire-9 (PHQ-9) for depression, Alcohol Use Disorder Identification Test (AUDIT) for alcoholism); (b) more scales to assess additional behavioral health problems (e.g., Patient Health Questionnaire Anxiety module for anxiety, Dimensions of Anger Reactions (DAR) for anger); (c) more extensive and formal clinical evaluations performed by psychologists, social workers, or chaplains to review the behavioral health issues; (d) and more formal triage process for referral to specialty services.

Statement of the Problem

The overall success of deployment force health protection efforts depends at least in part on the quality of post-deployment health assessments. Although the HRAIIv2 questionnaire has been used by the WRMC since 2004, there has been little assessment of its role to evaluate the current and future health of the deployed populations. Furthermore, public concern of the health of our Soldiers returning from combat is running high and there is a continual focus on the existing programs and services to meet the health related needs of service members and veterans.

The President, the U.S. Congress, and the Institute of Medicine have endorsed the improvement of health assessments and health surveillance of military members. Because of these concerns and those outlined above, this study will focus on the complete history of health measurement, military health surveillance and the predictors of self-rated health. Such documentation will strengthen the power of the HRAIIv2 survey and create a baseline document from which future work on the HRAIIv2 may be based.

Literature Review

Health Measurement

A literature review was conducted using PubMED and Google Scholar. The searches were limited to English-language articles, regardless of the year of publication, with the following search terms: health; self-rated health; self-rated quality of life; self-rated general health; health predictors; self reporting; health survey; health measurement. Articles were selected based on research focusing on both the military and civilian populations.

The sweeping definition of health is from the Preamble to the Constitution of the World Health Organization. It defines health as the state of complete physical, mental, social well being and not just the absence of disease or infirmity (WHO, 1948). This definition acknowledges that

health includes the mental aspects of our being and the fact that as human beings, we need social networks in order to thrive as well. It depicts the metaphysical, which some might say is related to the spiritual dimension, and the secular aspects of health. Health is maintained through the science and practice of medicine, but can also be improved by individual effort. Physical fitness, weight loss, a healthy diet, stress management training and smoking cessation and other substance abuse are examples of steps to improve one's health.

Aside from formal definitions, experts are learning that the way we feel about our health is very important. In fact, there is evidence that the way we perceive our level of health may be more important than true measures of health. Two areas to think about are: 1) how we feel and 2) how well we can function. How we feel is related to our attitude as well as true measures of health; an individual's perceptions of pain and limitations vary widely from person to person (Bjorner, Fayers, and Idler, 2005). People who feel well and have a positive attitude are more likely to actually be healthy as well. Ability to function is the ability to carry out minimal requirements for living can be another parameter for defining our health. It may be difficult to feel healthy when we cannot function independently. However, once again, there are many cases of individuals learning to adapt to disabilities and functioning very well over time.

Self-perceived health status is commonly used as an indicator of health and well-being (Haddock et al, 2007; Bjorner, Fayers, and Idler, 2005). Self-perceived health status is highly correlated with many objective measures of health status (Shi and Singh, 2004). Previous research indicates there are many factors that influence self-rated health, including mental health, lifestyle, depression, social support, physical and psychological stressors, pain, coping skills, income and inequality, job insecurity, and housing quality (Rohrer and Young, 2004). Shi and Singh (2004) suggest that health status is determined by a confluence of factors that can be

classified into four major categories: the person's individual behaviors, genetic makeup, medical practice, and the environment.

Single item self-assessments of health are the most widely used measures of health status. These self-assessments are used in many national surveys in the US, such as the National Health Interview Survey, National Health and Nutrition Examination Survey, and the Behavioral Risk Factor Surveillance System (Haddock et al., 2007). Research indicates that self-assessments of health are a predictor of mortality and morbidity, functional decline and disability, and utilization of health care (Hasson, Arnetz, Theorell, and Anderberg, 2006). Research also indicates that self-ratings of health are significantly related to measures of objective health status and thus are an economical means of gaining information about the health of the patient population (Ferraro, 1980). Public health initiatives in the United States need to target predictors of self-rated health in order to increase the public's health and well being.

Military Health Surveillance

A literature review was conducted using Pub MED and Google Scholar. The searches were limited to English-language articles, regardless of the year of publication, with the following search terms: military health assessment; deployment; health surveillance; PDHRA; PDHA; SWAP; Madigan Army Medical Center; Joint Medical Surveillance; DoD directives. Articles were selected based on research focusing on the military populations.

The Army formally began the process of health data collection in 1986 when DoD Directive 1010.10, Health Promotion and Disease/Injury Prevention, mandated the establishment of the Army Health Promotion Program. This directive resulted in the publication of Army Regulation (AR) 600-63 in November of 1987 to prescribe the policy, responsibilities, and procedures for the Army Health Promotion Program (AR 600-63, 1996). Directive 1010.10

further established the development of individual programs at DoD installations to create health promotion activities, health education programs, and health screening of beneficiaries.

In order to accomplish the assessment of the health status of Soldiers, AR 600-63, section 2-13, mandated the use of a health risk appraisal by providers to screen Soldiers, family members, Army civilians, and retirees for health risk factors (AR 600-63, 1996). The use of a health risk appraisal began in 1988 with a paper based health risk assessment (HRA) survey taken by individual Soldiers at varying times throughout their career. This survey changed versions several times after it was introduced.

The first major revision to the medical surveillance program was in the mid 1990s when researchers from the Institute of Medicine (IOM) evaluated the adequacy of the current clinical evaluation programs for veterans of the Gulf War. The IOM reports revealed that the lack of environmental and health surveillance data contributed to the inability to determine whether the Gulf War Illness was caused by environmental exposures (Joellenbeck, Russell, and Guze, 1999). They also emphasized the importance of medical surveillance for returning service members and recommended that standardized guidelines be developed for screening, assessing, evaluating, and treating this population. Additionally, in May of 1995, The Presidential Advisory Committee on Gulf War Veterans' Illness recommended that the National Science and Research Council develop an interagency plan to address health preparedness for the readjustment of veterans and families after future conflicts and peacekeeping missions (Trump, Muzzuchi, Riddle, Hyams, and Balough, 2002).

Major efforts were undertaken by governmental organizations and the Department of Defense (DoD) to address safeguards for the health of deployed U.S. service members during future deployments. In November 1997, President Clinton directed the DoD and the Department

of Veterans Affairs (VA) to create a new Force Protection Program (FHP) to help provide a

military force fully protected from preventable and avoidable health threats throughout military

operations and deployments. The goal was to develop a unified strategy in an effort to protect

service members from all health and environmental hazards associated with military service

(Joellenbeck, Russell, and Guze, 1999). The four critical elements of the FHP strategy were:

threat analysis, counter-measures, medical surveillance in the area of operations, and analysis.

The FHP served as a catalyst for defining new requirements for Joint Medical Surveillance

(JMS) (Trump, Muzzuchi, Riddle, Hyams, and Balough, 2002).

In 1997, the DoD released directive JMS and DoD Instructions (DoD I) 6490.3, the

Implementation and Application of JMS for Deployments, in an effort to meet the requirements

of the FMP (Trump, Muzzuchi, Riddle, Hyams, and Balough, 2002). Joint Medical Surveillance

established new operational requirements concerning the conduct of Preventive Medicine

operations within the DoD medical force structure. The DoD I 6490.3 required the military to

identify the populations at risk during deployments, determine potentially hazardous exposures

and conduct an overall assessment of troop health. These DoD source documents further

mandated the requirements for exposure monitoring and the development of innovative

technologies used for monitoring (Joellenbeck, Russell, and Guze, 1999).

The new surveillance policies brought changes in procedures for medical surveillance

immediately before, during, and after deployment. The pre-deployment questionnaire was

developed to provide a baseline measure of health status just prior to deployment. However, the

reliability and validity of this data was continually questioned because the assessment was taken

at a time when the service member was stressed and anxious (Joellenbeck, Russell, and Guze,

1999). In addition, clinicians were instructed to document exposure data in individual medical

records while on deployment, to include both environmental exposures and exposures to vaccines and other protective agents (Joellenbeck, Russell, and Guze, 1999). Finally, upon return from deployment, the service member was to complete a post deployment questionnaire, the Post Deployment Health Assessment (Form 2796). This questionnaire included questions pertaining to both physical and mental health symptoms and provided service members the opportunity to express concerns they may have about their health. Service members were required to complete the screening before departure from the area of operations or, failing that, within 30 days of their return. In addition, a blood sample was collected from each service member within 30 days of their return and the serum was sent to the Armed Forces Serum Repository (Joellenbeck, Russell, and Guze, 1999).

Aside from the completion of a brief self-reported health questionnaire and the collection of a blood sample from returning service members, no plans for additional special efforts for medical surveillance of returning troops were required from the DoD or the Department of Veterans Affairs. Those service members who remained on active duty in the military would resume care under their unit's regular garrison provider. This would include an annual Health Evaluation and Assessment Review survey and physicals at periodic intervals. Despite these JMS initiatives, it was still difficult to monitor the health of the deployed population, especially those who separated from the military (Joellenbeck, Russell, and Guze, 1999).

Following the start of the Global War on Terrorism, Force Health Protection was again on the front burner. The concept of using a survey instrument to assess the health and welfare of Soldiers continued to be developed at various locations throughout the Army. The PDHA was still used to evaluate the deployment-related health symptoms and acute conditions that were observed immediately after returning from combat theaters. However, in addition, the follow-up

Post-Deployment Health Reassessment (PDHRA, Form 2900) was developed to evaluate the deployment health symptoms three to six months post-deployment, based on observations that post-deployment military personnel may delay the presentation of their health symptoms after experiencing difficulty re-integrating with their family, community, and work environment (Hoge et al., 2004). The standard PDHRA included: self-reported items on physical health conditions (e.g., physical complaints and symptoms associated with chronic and acute conditions) and brief items about mental health problems (e.g., depression, PTSD, anger, and sleep disorders). The instrument also had questions about exposure to traumatic events and other types of environmental exposures. As with the PDHA, the clinician reviewed the service member's answers, conducted a brief interview, discussed options for care, and annotated any referral. Clinicians were directed to use clinical judgment in determining who needed referral rather than relying on cutoff criteria (Milliken, Auchterlonie, and Hoge, 2007).

In 2002, the staff of WRMC developed a new PDHRA that identified high risk Soldiers for proactive intervention and could also be used in a large scale screening initiative. The new survey, designated the Health Risk Assessment II (HRA II), was completed in September of 2003 and began beta testing in 2004. The HRA II meet the basic requirements of the PDHRA (same assessment as the PDHA, plus experience of injury and experience of exposure), with some additional features including: (a) several full scales included for assessing the target conditions of the PDHRA (e.g., Patient Health Questionnaire-9 (PHQ-9) for depression, Alcohol Use Disorder Identification Test (AUDIT) for alcoholism); (b) more scales to assess additional behavioral health problems (e.g., Patient Health Questionnaire Anxiety module for anxiety, Dimensions of Anger Reactions (DAR) for anger); (c) more extensive and formal clinical evaluation performed by psychologists, social workers, or chaplains to review the behavioral

health issues; (d) and more formal triage process for referral to specialty services. In the summer of 2007, additional questions were added to assess the experience of exposure and experience of injury for Traumatic Brain Injury (TBI). This enhanced HRA II was to serve as a measurement tool for identifying the health needs of Soldiers to return them to full combat readiness in the most expeditious manner possible.

Predictors of Self-rated Health

A literature review was conducted using Pub MED and Google Scholar. The searches were limited to English-language articles, regardless of the year of publication, with the following search terms: combat risk factors; predictors of self-rated health; combat stress; traumatic brain injury; brain injury; head injury; PTSD; depression. Active military service members are a unique population with regard to health outcomes. Generally, Soldiers are assumed to be in good physical and mental condition at the time of entry into the military, and individuals with reported mental disorders or physical impairments are often screened out. Because of this, articles for this literature review were selected based on research of both military and civilian populations.

Bjorner and colleagues (2005) performed a systematic literature review of explanatory variables for self-ratings of health. The studies differed markedly in population, explanatory variables included, and success in explaining self-rated health (R^2 ranging from 5 to 75%). However, four types of explanatory variables were consistently and strongly associated with self-rated health: medical diagnosis, physical symptoms, physical function, and mental symptoms. Additionally, health seemed to have a slightly U-shaped relation with age (the youngest and the oldest age groups having the best self-ratings) and weak associations were seen for ethnicity (Caucasians having better self-ratings) and employment (people employed having better self-

ratings). Higher education was consistently associated with better self-ratings of health, even for people of equal health status according to other health indicators (Bjorner, Fayers, and Idler, 2005).

The report from Bjorner and colleagues (2005) indicates that gender was not significantly associated with self-ratings, when controlling for other measures of health. However, recent findings and theories in stress research and occupational health indicate there are contradictory findings about the presence of gender differences in stress, coping, and health (Adler, Huffman, Bliese, and Castro, 2005). Some research has found stress responses to be similar, whereas other research has found gender differences in responses to stressors. For example, Adler, Huffman, Bliese, and Castro (2005) demonstrated a different stress response pattern for men and women when analyzing the impact of deployment length and combat experience on well-being.

Studies of trauma survivors consistently show that exposure to a traumatic event is associated with increased risk of negative psychological outcomes, especially posttraumatic stress disorder (Kessler, Sonnega, Bromet, Hughes, and Nelson, 1995; Kulka et al., 1990). During deployment, soldiers may be exposed to potentially traumatic events, incur war-related injuries, or be exposed to chemical toxins that lead to complicated health problems. PTSD may develop following exposure to trauma and is particularly prevalent in individuals exposed to war (Kessler et al., 1995; Kulka et al., 1990).

Perhaps less widely recognized is the fact that trauma is associated with poor physical health as well. For example, Friedman and Schnurr (1995) concluded that trauma is linked to poor self-reported health, and greater medical service utilization, morbidity, and mortality. In addition, Felitti et al. (1998) concluded that childhood trauma was associated with increased likelihood of a variety of disorders, including ischemic heart disease, stroke, cancer, and chronic

bronchitis and emphysema (Felitti et al., 1998). Furthermore, a longitudinal study of male World War II (WWII) veterans found that combat was linked to physical decline or death during early to middle adulthood, although not during later life (Elder, Shanahan, and Clipp, 1997). Another longitudinal study of WWII veterans reported that heavy combat exposure was associated with increased likelihood of death or chronic illness before age 65 (Lee, Vaillant, Torrey, and Elder, 1995).

Purpose

The purpose of this study is to examine the correlates of combat related environmental risk factors with the self-rated health of U.S. Army Soldiers returning from a combat deployment. It will answer the question "What combat-related environmental risk factors affect self-rated health?" The aim is to determine the most salient combat exposure risk factors and use them to construct a prediction model for future self-rated health. This study is important because it may help develop early detection and intervention programs to prevent chronic mental illness among OEF/OIF veterans. If the significant exposure factors can be identified and the subsequent health properly managed, the overall health of the population may increase without significant medical intervention and thus the overall costs of providing care may decrease. This subject is significant within the Department of Defense, because a statistically significant predictive model may be used to set the conditions for the medical system to respond in order to increase the health of the Soldiers returning from combat.

Methods and Procedures

Methods

This research was designed as a single cross-sectional analysis (randomization, HRA IIv2 treatment and observation; RXO). The data used for this study was collected through the Soldier

Wellness Assessment Program (SWAP) at Fort Lewis, Washington, Fort Richardson, Alaska and Fort Wainwright, Alaska. The SWAP uses the most current version of the Health Risk Assessment II Survey (HRA IIv2), which was designed to identify physical and mental health concerns of Soldiers 90-180 days after their return from a deployment. The data from the SWAP was collected from MAMC's Microsoft Structured Query Language (SQL) server, which consists of responses from 7,347 Soldiers surveyed from June 2007 through June 2008. The data was transformed and analyzed using the Statistical Package for the Social Sciences (SPSS) version 14.0. Surveys that had missing or incomplete data were excluded from the study. The amount of data collected from the Reserve and National Guard Soldiers returning from deployment was minimal, so the data was excluded from the study. The final sample size for this study was 7,315 surveys.

The conceptual model for this research was established using Bacharach's (1989) theoretical model framework (Figure 1). The proposed theoretical model used in this model is the Health Determinants Theory, where genetics, lifestyle, environment and health services utilization determine the health of an individual (Shi and Singh, 2004).

The constructs for this model are: environmental risk factors and the individual's health; the proposition between the two constructs is that environmental risk factors affect a person's health. The environmental risk factor construct is operationalized into two variables: physical exposure and psychological exposure, while the construct of health is operationally defined by quality of life and self-rated health. The variables are operationalized into discrete measurements that allow the relationships between the dependent and independent variables to be effectively understood.

For this analysis, several common questions from the HRAIIv2 survey were selected to assess the combat related environmental risk factors and overall health of U.S. Army Soldiers returning from a combat deployment. The overall health was assessed using the single-item self-rated health status (y), which asked the question, "Would you describe your general health as:" The responses were categorical on a bipolar adjective scale: 1=excellent, 2=very good, 3=good, 4=fair, 5=poor. This data were recoded as: 0=poor, 1=fair, 2=good, 3=very good, 4=excellent.

	Measures:	
x1 Combat Injury	x5 #OIF/OEF Deployments	y Self-rated general health
x2 Deployment Was Hurt	x6 Combat See Killing	
x3 Blast Head Injury	x7 Combat See Dead	
x4 Non-Combat Head Injury	x8 Combat Kill	
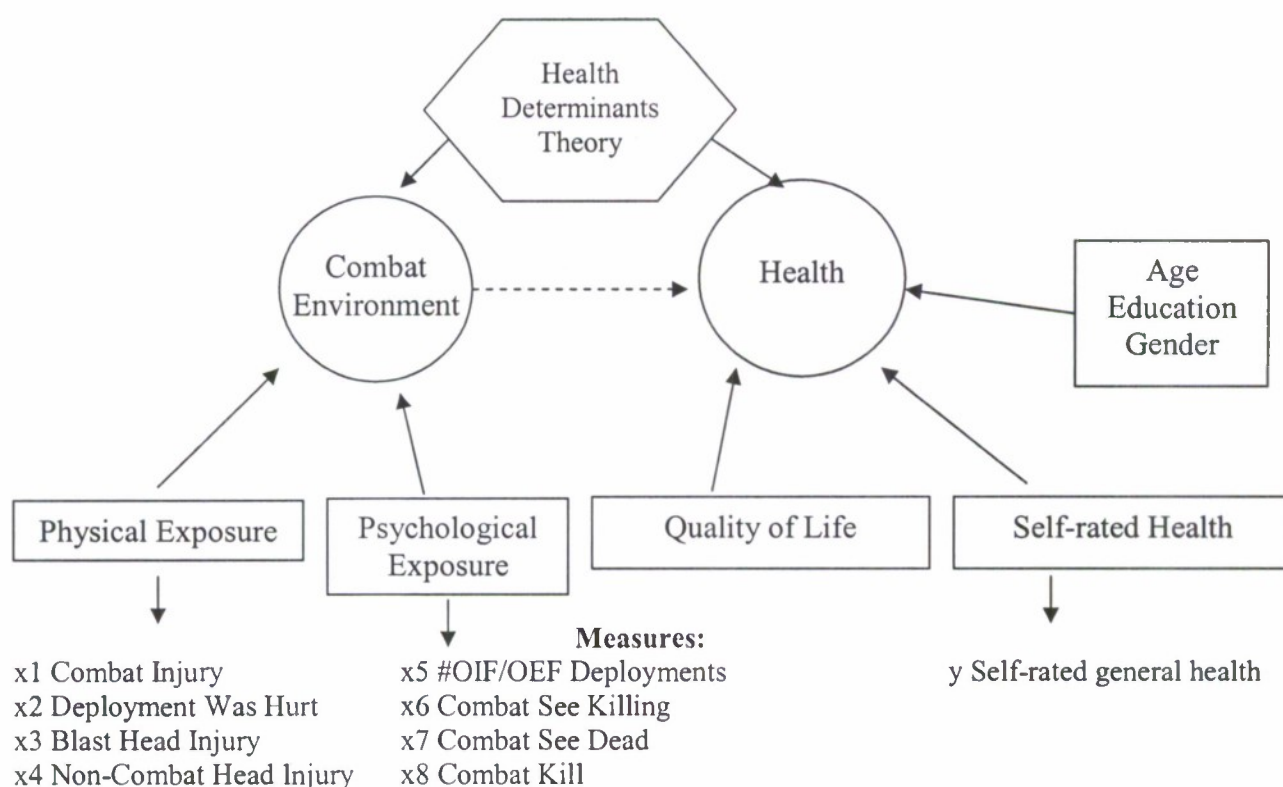
Figure 1. Conceptual model using the Health Determinants Theory (Shi and Singh, 2004).

The combat exposure measures for this study were selected from the HRAIIv2. The eight items were selected to be the most representative measures of the service members' exposure to a variety of war-related events and circumstances. These traditional combat related exposures were differentiated into physical and psychological exposures. The responses to the physical

exposures questions are binary and coded as either 0=no and 1= yes. The first physical exposure predictor is "combat injured" (x1), which was defined by the survey as: "During combat operations did you become wounded or injured?" The second predictor, "deployment hurt" (x2) was defined by the survey as: "During the deployment, were you wounded, injured, assaulted, or otherwise physically hurt?" The third variable is "blast head injury" (x3), which was defined by the survey as: "While deployed, were you exposed to or near a blast, IED explosion, car bomb, suicide explosion, or exposed to any other combat event that caused a blow or jolt to your head?" And the fourth variable is "non-combat head injury" (x4), which was defined by the survey as: "While deployed, were you involved in a motor vehicle accident, a fall, a sports accident, or any other event that caused a blow to your head or that resulted in a neck whiplash?" If there is covariation identified between any of these four variables, the most salient variables will be used or the responses will be combined into a single variable.

The next four variables are related to psychological exposures. The first predictor variable is the "total number of OIF/OEF deployments" in the last five years (x5). The survey data are continuous and coded as: 0, 1, 2, 3, 4, 5... The next three psychological predictors are binary and coded as either 0=no, 1=yes. They are "combat see killing" (x6), which is defined by the survey as: "During combat operations did you personally witness anyone being killed?"; "combat see dead" (x7), which was defined by the survey as: "During combat operations did you see bodies of dead soldiers or civilians?"; "combat kill" (x8), which was defined by the survey as: "During combat operations did you kill others in combat (or have reason to believe that others were killed as a result of your actions?" If there is covariation identified between these three binary variables, the most salient variable will be used or the responses will be combined into a single variable.

Based on the literature review, three demographic variables will be used as controls for this study. To assess age (d1), the survey asks for the respondent's date of birth. This data will be converted into age categories: 0= 18-21; 1= 22-26; 2= 27-31; 3= 32-36; 4= 37 and above. To assess education (d2), the survey asks: "What is the highest level of education you have received in school?" The responses are categorical: 0= some high school, 1= high school grad, 2= some college, 3= associates, 4= bachelors, 5= postgraduate or professional degree. To assess gender (d3), the survey asks" Are you male or female?" The responses are binary: 0=male, 1=female. Coding for the dependent and independent variables is shown in Table 1.

Procedures

Statistical Package for Social Sciences (SPSS), version 14.0, is utilized in this study to calculate the descriptive and inferential statistics. The unit of analysis is the self-rated health of Soldiers returning from OIF/OEF deployments from June 2007 through June 2008. This study will use multiple regression analysis to describe, explain, predict and test hypotheses associated with self-rated health as a function of exposure to the combat environment. The predictive model is described as: $Y1 = b0 + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 + b8x8 + b9d1 + b10d2 + b11d3 + \mathcal{C}$ (y1 is the self-rated general health; b0 is the regression constant, or the Y intercept; bn is the partial regression coefficient or the slope associated with xn and dn; xn represents the combat exposure predictors; dn represents the demographic predictors; $\mathcal{C}$ represents random error). The formal null and alternate hypotheses in terms of a no difference model versus a difference model were: Null Hypothesis H_0: $b1 = b2 = b3 = b4 = b5 = b6 = b7 = b8 = b9 = b10 = b11 = 0$, or combat environment exposures and demographic factors are not predictors of the overall self-rated health; alternative hypothesis H_a: $b1 \neq b2 \neq b3 \neq b4 \neq b5 \neq b6 \neq b7 \neq b8 \neq b9 \neq b10 \neq b11 \neq 0$, or combat environment exposures and demographic factors are

Table 1.

Variable Description and Coding

	Variable	Description	Operationalized	Data Source
y1	Self-Rated Health	Self assessment of general health using bipolar adjective scale	0= Poor 1= Fair 2= Good 3= Very Good 4= Excellent	HRAIIv2 Survey
x1	Combat Injured	During combat operations did you become wounded or injured?	0= no, 1= yes	HRAIIv2 Survey
x2	Deployment was hurt	During the deployment, were you wounded, injured, assaulted, or otherwise physically hurt?	0= no, 1= yes	HRAIIv2 Survey
x3	Blast Head Injury	While deployed, were you exposed to or near a blast, IED explosion, car bomb, suicide explosion, or exposed to any other combat event that caused a blow or jolt to your head?	0= no, 1= yes	HRAIIv2 Survey
x4	Non-combat Head Injury	While deployed, were you involved in a motor vehicle accident, a fall, a sports accident, or any other event that caused a blow to your head or that resulted in a neck whiplash?	0= no, 1= yes	HRAIIv2 Survey
x5	Total Deployments	Your total Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) deployments in the last five (5) years?	0, 1, 2, 3, 4, 5…	HRAIIv2 Survey
x6	Combat See Killing	During combat operations did you personally witness anyone being killed?	0= no, 1= yes	HRAIIv2 Survey
x7	Combat See Dead	During combat operations did you see the bodies of dead Soldiers or civilians?	0= no, 1= yes	HRAIIv2 Survey
x8	Combat Kill	During combat operations did you kill others in combat (or have reason to believe that others were killed as a result of your actions)?	0= no, 1= yes	HRAIIv2 Survey
d1	Age Category	Date of birth converted to age category	0= 18-21 1= 22-26 2= 27-31 3= 32-36 4= 37 and above	HRAIIv2
d2	Education	What is the highest level of education you have received in school?	0= Some high school 1= High School Grad 2= Some College 3= Associates 4= Bachelor's degree 5= Postgraduate	HRAIIv2
d3	Gender	Are you male or female?	0= Male 1=Female	HRAIIv2

predictors of the overall self-rated health. For both hypotheses, the α-level is set at .05.

Validity and Reliability

Statistical power analysis is a means to determine the probability of receiving a statistically significant result given that there is a real effect in the population. Power is defined as 1-beta and can be interpreted to correctly reject the null when it is in fact false. The power analysis is based on three factors: sample size, effect size, and alpha level. Effect size is based on the assessment of the researcher based on his confidence in the relationship between the variables (high, medium, and low). Alpha level is also generally set by the researcher, which is an assessment of the likelihood of committing a Type 1 error (rejecting the null when it is true).

In the case of this study effect size is defined as .1, due to the stratified sample process used to obtain a representative sample of the overall population (n=N). Alpha is .05, meaning there is a 5% chance that the null hypothesis will be rejected when it is true. With this information, the power = 89%, assuming an effect size of .10, 95% CI, alpha =.05, n=>1,000. The power of 89% means that there is a high probability of getting a statistically significant result.

<div align="center">Results</div>

Summary of Self-Rated Health and Related Predictors

Table 2 shows an overall self-rated health average of 2.49, between the scale points of 2 (good) and 3 (very good) on the 5-point rating scale, for the entire 7,315 case sample. Variability, shown by the standard deviation (SD), was approximately ±.88 rating scale point about the average, as consistently observed for all other computed self-rated health averages. Table 2 shows the frequencies, percentages, and self-rated health means and SDs for individual demographics. Table 3 shows the Pearson's *r* values between individual demographics, combat

Table 2.

Descriptive Statistics: Individual Demographics Data for Self-Rated Health Respondents

Variable	Number	Percent	Self Rated Health	
			Mean	SD
Self-Rated Health	7,315	100.00	2.49	.88
Age Group (years)[a]				
18 to 21	1,078	14.74	2.60	.86
22 to 26	3,299	45.10	2.46	.87
27 to 31	1,485	20.30	2.50	.88
32 to 36	820	11.21	2.49	.89
37 and above	633	8.65	2.45	.89
Education[b]				
Some HS	264	3.61	2.30	.91
HS Graduate	2,772	37.89	2.44	.89
Some College	2,954	40.38	2.46	.83
Associates	400	5.47	2.44	.87
Bachelors	732	10.01	2.78	.90
Postgraduate	193	2.64	2.99	.92
Gender[c]				
Male	6,899	94.31	2.50	.88
Female	416	5.69	2.36	.89

[a] $n=7,315$; Age Group correlation with SRH: $r = -.026$; $p=.013$

[b] $n=7,315$; Education correlation with SRH: $r = .133$; $p=<.001$

[c] $n=7,315$; Gender correlation with SRH: $r = -.037$; $p=.001$

related environmental factors, and self-rated health. Table 4 displays means, SDs and self-rated health correlations among combat related environmental factors. Tables 5, 6, and 7 show the inferential statistics results from the multiple linear regression.

As with previous studies, age, education (Bjorner, Fayers, and Idler, 2005) and gender (Adler, Huffman, Bliese, and Castro, 2005) emerged as significantly related to self-rated health (Table 2). Each of these demographic categories were treated as a set of mutually exclusive and categorically exhaustive variables, which allowed an inspection of frequencies and percentages of the separate groups. Average self-rated health scores ranged from 2.60 for the 18- to 21-year old group to 2.45 for the >37-year old group. Health status was shown to be correlated negatively and significantly with age ($r = -.026, p = .013$). Additionally, self-rated health status was shown to be correlated positively and significantly with education ($r = .133, p = <.001$). Further differences showed that male subjects appeared to be healthier (mean, 2.50) than female subjects (mean, 2.36; $r = -.037, p = -.001$).

Of the four physical exposure items (Table 4), all exhibited weak to moderately negative correlations with self-rated health. Fifteen percent of respondents reported being wounded in combat ($r = -.136, p = <.001$), while 22 percent reported being hurt on deployment ($r = -.181, p = <.001$). However, the highly positive correlation between these two variables ($r = .714, p = <.001$; Table 3) indicates the variables have a significant amount of covariation. Because of this, the responses for both variables were combined into a single variable, "injured or hurt" (c_1), with a binary response (0 = no; 1 = yes). This new variable has 23 percent of respondents reporting being injured or hurt, and a negative correlation with self-rated health ($r = -.184, p = <.001$).

Of the 7,315 respondents, 48 percent reported being exposed to a blast, IED explosion, car bomb, suicide explosion, or other combat event that caused a blow or jolt to their head ($r = -$

.094, p = <.001). Furthermore, 15 percent reported being involved in a motor vehicle accident, a fall, a sports accident, or other non-combat event that caused a blow to their head or that resulted in a neck whiplash (r = -.148, p = <.001). However, the moderately positive correlation between the two variables (r = .316, p = <.001; Table 3) along with the large amount of "yes" responses for "blast head injury", indicates the variables have a significant amount of covariation. Because

Table 3.

Correlation Matrix: SRH, Combat Related Environmental Factors and Individual Demographics

Variable	x1	x2	x3	x4	x5	x6	x7	x8	d1	d2	d3
Self-Rated Health (y)	-.136	-.181	-.094	-.148	-.072	-.075	-.061	-.028	-.026	.133	-.037
Combat Injured (x1)		.714	.298	.274	.066	.206	.177	.220	.015	-.036	-.043
Deployment Hurt (x2)			.306	.316	.041	.205	.189	.212	.015	-.031	-.046
Blast Head Injury (x3)				.316	.012	.461	.428	.369	-.089	-.121	-.157
Non-Combat Head Injury (x4)					.017	.230	.183	.213	-.047	-.068	-.059
Total OIF/OEF Deployments (x5)						.036	.028	.050	.282	-.022	-.021
Combat See Killing (x6)							.565	.538	-.031	-.078	-.174
Combat See Dead (x7)								.398	-.014	-.029	-.184
Combat Kill (x8)									-.040	-.053	-.157
Age Category (d1)										.445	-.018
Education (d2)											.084

of this, the responses for both variables were combined into a single variable, "head injury" (c2), with a binary response (0 = no; 1 = yes). This new variable, with 50 percent of respondents reporting a head injury, was shown to be correlated negatively and significantly with self-rated

Table 4.

Descriptive Statistics: Combat Related Environmental Factors and Self-Rated Health

Variable	Mean	SD	Self Rated Health	
			r	*p*
Physical Exposure				
Combat Injured [a]	.15	.35	-.136	<.001
Deployment Was Hurt [a]	.22	.41	-.181	<.001
Blast Head Injury [a]	.48	.50	-.094	<.001
Non-Combat Head Injury [a]	.15	.36	-.148	<.001
Psychological Exposure				
Total OIF/OEF Deployments	1.58	.85	-.072	<.001
Combat See Killing [a]	.47	.50	-.075	<.001
Combat See Dead [ad]	.70	.46	-.061	<.001
Combat Kill [a]	.35	.48	-.028	.009
Combined Physical Exposure Variables				
Injured or Hurt [ab]	.23	.42	-.184	<.001
Head Injury [ac]	.50	.50	-.109	<.001

n=7,315 HRA IIv2 Surveys

[a] Binary Coded: 0, no; 1, yes

[b] The combined responses for the combat injured and deployment was hurt variables.

[c] The combined responses for the blast head injury and non-combat head injury variables.

[d] Variable removed from the adjusted model.

health (r = -.109, p = <.001). Both the "injured or hurt" and the "head injury" variables were used in the adjusted multiple linear regression model.

Association of psychological exposures and self-rated health were examined next. Of the four psychological exposure items (Table 4), all exhibited weak negative correlations with self-rated health. Correlations ranged from a value of r = -.028 for respondents that reported killing someone in combat to r = -.075 for those that reported seeing someone killed. The average number of deployments was 1.58 with a SD of .85. Along with this, 47 percent reported they had personally witnessed someone being killed, 70 percent reported they saw dead bodies of Soldiers or civilians, and 35 percent reported they killed someone during combat. The moderately positive correlations between the three variables (r = .398, .538, .565; Table 3) along with the large amount of "yes" responses for "combat see dead" indicates the variables have a significant amount of covariation. Because of this, the "combat see dead" (x7) variable was removed from the adjusted multiple linear regression model.

Discussion

Model Summary and Comprehensive Assessment

The multiple linear regression analysis for self-rated health as a function of combat related environmental and individual demographic factors is shown in Tables 5 and 6. The full model used the following predictors of self-rated health: "combat injured" (x1), "deployment was hurt" (x2), "blast head injury" (x3), "non-combat head injury" (x4), "total deployments" (x5), "combat see killing" (x6), "combat see dead" (x7), "combat kill" (x8), "age category" (d1), "education" (d2), and "gender" (d3). Performing multiple linear regression produced a model correlation coefficient (R) of .271, a multiple coefficient of determination, R^2, of .073, and an

adjusted R^2 value of .072. This adjusted R^2 value indicates that the 7.2% of the variance in the

self rated health can be attributed to the variance in the model.

Table 5.

Multiple Linear Regression Analysis: Full and Adjusted Model Summaries

	R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin Watson	$df1$	$df2$	F	p
Full Model[a]	.271	.073	.072	.846	1.980	11	7,303	52.55	<.001
Adjusted Model[b]	.260	.068	.067	.848	1.978	8	7,306	66.21	<.001

[a] Predictors: Combat Injured, Deployment Was Hurt, Blast Head Injury, Non-Combat Head Injury, Total

Deployments, Combat See Killing, Combat See Dead, Combat Kill, Education, Age Category, Gender; Dependent

variable: Self-rated Health.

[b] Predictors: Injured or Hurt, Head Injury, Total Deployments, Combat See Killing, Combat Kill, Education, Age

Category, Gender; Dependent variable: Self-rated Health.

The critical value for F with 11 degrees of freedom in the numerator and 7,303 degrees of

freedom in the denominator using a two-tailed test with an α-level of .05 is 1.96 (Sanders &

Schmidt, 2000). The model's computed $F_{(11, 7,303)}$ value of 52.55 was well above the critical

value and the computed p value was well below α=.05, indicating the results are statistically

significant. However, the results in Table 6 indicates three of the independent variables (x1,

x3,x7) have coefficients that are not statistically significant, with computed $T_{(7,303)}$ values below

1.96 and p values well above α=.05. The statistical evidence suggests that the model's

independent variables are not significant predictors of self rated health and therefore failed to

reject the null hypotheses, H_0: b1 = b2 = b3= b4 = b5 = b6 = b7 = b8 = b9 = b10 = b11 = 0.

Model Refinement

An adjusted predictive model was developed based on the results of the full model's multiple linear regression. The adjusted model had the following predictors of self-rated health: "injured or hurt" (c1), "head injury" (c2), "total deployments" (x5), "combat see killing" (x6),

Table 6.

Multiple Linear Regression Analysis: Full Model Coefficients

Variable	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	p
Full Model (Constant)	2.562	.032		80.00	<.001
Combat Injured (x1)	.011	.041	.004	.27	.789*
Deployment Was Hurt (x2)	-.307	.035	-.145	-8.80	<.001
Blast Head Injury (x3)	-.024	.024	-.014	-1.00	.318*
Non-Combat Head Injury (x4)	-.232	.030	-.095	-7.68	<.001
Total Deployments (x5)	-.038	.012	-.037	-3.08	.002
Combat See Killing (x6)	-.060	.027	-.034	-2.22	.026
Combat See Dead (x7)	-.039	.027	-.020	-1.43	.154*
Combat Kill (x8)	.092	.025	.050	3.64	<.001
Age Category (x9)	-.073	.010	-.094	-7.05	<.001
Education (x10)	.134	.010	-.167	12.98	<.001
Gender (x11)	-.264	.044	-.070	-6.00	<.001

Dependant Variable: SRH; $F_{(11, 7,303)} = 52.55$, $p=<.001$, $R^2 = .073$.

*Not Significant

"combat kill" (x8), "age category" (d1), "education" (d2), and "gender" (d3). The predictive

model is described as $Y1 = b0 + b1c1 + b2c2 + b5x5 + b6x6 + b8x8 + b9d1 + b10d2 + b11d3 +$

ϵ (y1 is the self-rated general health.; b0 is the regression constant, or the Y intercept; bn is the

partial regression coefficient or the slope associated with cn, xn and dn; cn represents the

combined combat exposure predictors; xn represents the combat exposure predictors; dn

represents the demographic predictors; ϵ represents random error). The formal null and alternate

hypotheses in terms of a no difference model versus a difference model were: Null Hypothesis

H_0: $b1 = b2 = b5 = b6 = b8 = b9 = b10 = b11 = 0$, or combat environment exposures and

demographic factors are not predictors of the overall self-rated health; alternative hypothesis H_a:

$b1 \neq b2 \neq b5 \neq b6 \neq b8 \neq b9 \neq b10 \neq b11 \neq 0$, or combat environment exposures and

demographic factors are predictors of the overall self-rated health. For both hypotheses, the α-

level is set at .05.

The multiple linear regression analysis of the adjusted model is shown in Tables 5 and 7.

Performing multiple linear regression produced a model correlation coefficient (R) of .260, a

multiple coefficient of determination, R^2, of .068, and an adjusted R^2 value of .067. This adjusted

R^2 value indicates that the 6.7% of the variance in the self rated health can be attributed to the

variance in the model. Multiple linear regression analysis produced a predictive equation of: Y =

2.552 -.340c1 - .092c2 -.037x5 -.074x6 + .082x8 - .072d1 + .134d2 - .262d3 + ϵ, with $F_{(8, 7,306)} =$

66.21. Using the sample means to solve for ϵ resulted in a value of .030. The standardized

coefficients indicate that being injured or hurt has the most weight in the model (changes have

the most influence on self-rated health). The negative slope of the variables (c1, c2, x5, x6, d1,

d3), along with their negative values of r, indicate they have an inverse relationship with self-

rated health. The positive slope of the education variable (d2), along with the positive value of r,

indicates a positive relationship with self-rated health. The model produced a Durbin-Watson value of 1.978, illustrating little autocorrelation in the model. The positive slope of the "combat kill" variable (+.082), along with its negative value of r (-.028), indicates there still may be some autocorrelation. An easy explanation for this phenomenon is the fact that the majority of the

Table 7.

Multiple Linear Regression Analysis: Adjusted Model Coefficients

Variable	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	p
Adjusted Model (Constant) [a]	2.552	.030		83.77	<.001
Injured or Hurt (c1) [b]	-.340	.025	-.163	-13.54	<.001
Head Injury (c2) [c]	-.092	.023	-.052	-3.93	<.001
Total Deployments (x5)	-.037	.012	-.036	-2.99	.003
Combat See Killing (x6)	-.074	.025	-.042	-2.96	.003
Combat Kill (x8)	.082	.025	.045	3.27	.001
Age Category (d1)	-.072	.010	-.093	-6.95	<.001
Education (d2)	.134	.010	-.168	13.00	<.001
Gender (d3)	-.262	.044	-.069	-5.96	<.001

Dependant Variable: SRH; $F_{(8, 7,306)} = 66.21$, p=<.001, $R^2 = .067$.

[a] The "combat see dead" variable was removed from the model.

[b] The combined responses for the "combat injured" and "deployment was hurt" variables.

[c] The combined responses for the "blast head injury" and "non-combat head injury" variables.

"yes" responses for "combat kill" come from the younger age categories (matching the demographics of the Army's force structure), which report a higher self-rated health.

The adjusted model's computed $F_{(8, 7,306)}$ value of 66.21 was well above the critical value of 1.96 and the computed p value was well below $\alpha=.05$, indicating the model's results are statistically significant. Additionally, the coefficient table (Table 7) indicates the independent variable coefficients are all statistically significant, with computed $T_{(7,306)}$ values above 1.96 and p values well below $\alpha=.05$. Therefore the null hypotheses, H_0: $b1 = b2 = b5 = b6 = b8 = b9 = b10 = b11 = 0$, was rejected and the alternate hypotheses, H_a: $b1 \neq b2 \neq b5 \neq b6 \neq b8 \neq b9 \neq b10 \neq b11 \neq 0$, was accepted. The statistical evidence suggests that the model's independent variables are significant predictors of self rated health with a final predictive model of $Y = 2.552 -.340c1 - .092c2 -.037x5 -.074x6 + .082x8 - .072d1 + .134d2 - .262d3 + .030$, with $F_{(8, 7,306)} = 66.21$.

The predictive model demonstrated the successful use of the HRA IIv2 in Military Medicine. This study demonstrates that conducting and evaluating a HRAIIv2 survey can serve as a basis for assessing and/or implementing successful preventative health plans for the U.S military. Furthermore, given its brevity and apparent validity as a marker for health, self-rated health may prove to be a useful tool for assessing health status among young military members redeploying from combat, providing at least two important benefits for military leaders. First, using self-rated health as a population screener will enable the military to better target preventive health interventions. It is difficult and costly to direct treatment efforts at all service members, so simple screening tools are needed to target the limited resources. This study suggests that even a single-item assessment of health would provide useful information for military health planners. Second, statistically significant self-rated health measures, along with a predictive model, could

help the military to profile the health of troops. If measures of self-rated health significantly

change over time, reasons for the changes in population health could be identified.

Additional Analysis of SRH, Number of Deployments, Age and Education

Associations of "self-rated health" (y1), "total deployments" (x5), "age" (d1) and

"education" (d2) were further examined. Analysis of the correlation matrix (Table 3) shows that

"age" was correlated positively with the "total number of deployments" ($r = .282$, $p = <.001$) and

"education" ($r = .445$, $p = <.001$). Accordingly, univariate general linear models were developed

to uncover the main and interaction effects of the independent variables (x5, d1, and d2) on the

dependent variable (y1). A main effect is the direct effect of an independent variable on the

dependent variable. An interaction effect is the joint effect of two or more independent variables

on the dependent variable (Sanders and Smidt, 2000).

A single factor univariate analysis was used to test the main effect of each independent

variable on the dependent variable (Table 8). The results reveal that "total deployments" ($F_{(9,}$

Table 8.

Univariate General Linear Model: Single Factor Analysis

Variable	R^2	Adjusted R^2	df	Mean Square	F	p
Total Deployments [a]	.008	.006	9	4.756	6.21	<.001
Age [b]	.003	.003	4	4.655	6.05	<.001
Education [c]	.023	.023	5	26.392	35.02	<.001

[a] Independent Variable: Total OIF/OEF Deployments; Dependent variable: Self-rated Health

[b] Independent Variable: Age; Dependent variable: Self-rated Health

[c] Independent Variable: Education; Dependent variable: Self-rated Health

$_{7,305)} = 6.21$, p=<.001, R^2 = .008), "age" ($F_{(4, 7,310)} = 6.05$, p=<.001, R^2 = .003), and "education"

($F_{(5, 7,309)} = 35.02$, p=<.001, R^2 = .023) each have statistically significant effects on "self-rated

health". Next, a complete factorial model was used to explore the main and interaction effects

(Table 9). The results of the complete factorial model indicate there is no significant interaction

Table 9.

Univariate General Linear Model: Complete Factorial Model

Variable	Type III Sum of Squares	df	Mean Square	F	p
Corrected Model [a]	332.794 [b]	147	2.264	3.06	<.001
Intercept	612.365	1	612.365	826.93	<.001
Total OIF/OEF Deployments	13.120	9	1.458	1.97	.039
Age	7.181	4	1.795	2.42	.046
Education	18.542	5	3.708	5.01	<.001
Total Deployments*Age	25.615	28	.915	1.24	.183[*]
Total Deployments*Education	29.050	32	.908	1.23	.178[*]
Age*Education	17.070	18	.948	1.28	.189[*]
Deployments*Age*Education	34.646	51	.679	.917	.641[*]
Error	5307.352	7167	.741		
Total	51027.000	7315			
Corrected Total	5640.145	7314			

[*] Not Significant

[a] Independent Variables: Total Deployments, Age, Education; Dependent variable: SRH

[b] R^2 = .059 (Adjusted R^2 = .040)

between the independent variables ($F<1.96$, $p>.05$). The F statistic for the "total deployments"

main effect is 1.97 with an observed significance level of .039, indicating the variable "total

deployments" has a statistically significant influence on "self-rated health". The F statistic for

the "age" main effect is 2.42 with an observed significance level of .046, indicating the variable

"age" has a statistically significant influence on "self-rated health". And finally, the F statistic

for the "education" main effect is 5.01 with an observed significance level that is <.001,

indicating the variable "education" has a statistically significant influence on "self-rated health".

These results confirm the previous findings; additionally, they verify that higher education has

the most significant effects on self-rated health.

Issues and Limitations

Data integrity is an issue as the data used is from the SWAP using the HRAv2. The data

is self reported data taken by computer kiosk which may represent bias from the person taking

the survey. Surveys are associated with subjective measurements defined by the individuals; as

opposed to actual measurements (what is excellent health for one person may not be the same

excellent health evaluation of another). The subjective nature of the survey results limits the

comparability of data across the population without confirmation or verification from a medical

records screening. Finally, as discussed later, many of the predicator variables are dichotomous

or categorical, which limits the predictive value of a regression analysis, which assumes central

tendency characteristics.

Multiple linear regression is a statistical technique and the application allows for a linear

assessment of the degrees of correlation between predictor variables and the dependent variable.

Multiple regression models assume that all variables are normally distributed in a bell shape

fashion, with 95% of the variables located under the normal curve. This assumption of normality

and central tendency is problematic when variables are either categorical or dichotomous (as is the case in this study). Furthermore, regression analysis assumes data is homoscedasitic, meaning the $\mathcal{E}$ term in the regression analysis is constantly applied to all variables uniformly.

Additionally, this study was only conducted using one military service, which was active duty. While the results of this study can be considered generalizable to the larger population of service members they represent, it is unknown whether these results generalize to other military branches, foreign military services, or related organizations. Furthermore, studying military units post-deployment is likely to exclude service members who are at highest risk for mental health problems, such as those with severe injuries or those who have separated from military service. In addition to these studies' limited generalizability, most studies suffer from other limitations common to many epidemiological studies. For example, for all of the post-deployment studies, individuals with the most significant mental health problems may be unavailable or unable, or unwilling to participate in the survey. Moreover, individuals may not report problems or give perceived "desirable" responses in an effort to get out of the screening process quickly. Either way would lead to more-conservative estimates of prevalence than is actually the case.

Conclusions

The overall self-rated health average for survey respondents was 2.49, between the scale points of 2 (good) and 3 (very good) on the 5-point rating scale. The adjusted regression model to predict self-rated health was significant. The findings of this study are consistent with the previous studies of self-rated health among military members, which demonstrates a strong relationship between self-rated health, certain individual demographics (age, higher education, and gender), and combat related environmental risk factors. Obtaining higher education was the most salient predictor of better self-rated health. The occurrence of physical injury or physical

harm during combat was the most salient predictor of poorer health. The psychological factor of seeing dead bodies of Soldiers or civilians was not significant to the predictive model.

Recommendations

Additional research is needed to determine if the results found in this study generalize to the other military branches or other security services. Additional research on the longitudinal relationship between overall self-rated health and health risk factors may also prove useful. Furthermore, follow-on studies should focus on the physical and psychological variables, to include symptoms related to the factors. Future research should also focus on the impact interventions focused on health behaviors and behavioral intentions have on overall self-rated health. It is possible that overall self-rated health status may serve as a viable measure of the efficacy of health interventions.

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